

OSMOREGULATION IN THE FRESHWATER SHRIMP, *MACROBRACHIUM CARCINUS* (LINNAEUS)

River shrimps of the genus *Macrobrachium* are decapods of great economic importance and are widely distributed throughout Mexico, principally *M. carcinus*, *M. acanthurus*, *M. heterochirus* and *M. olfersii* in the Gulf of Mexico, and *M. americanum* and *M. tenellum* on the Pacific coast. Some of these shrimp require brackish water to complete their larval development and have different physiological responses to salinity. However, before cultivation of these species many investigations of their physiological requirements are necessary. Osmoregulation in decapods has been the subject of many investigations but data for the genus *Macrobrachium* are relatively few and most information available in this respect concerns *M. rosenbergii*. Moreira *et al.* (1983, 1987) have verified the effect of salinity in the metabolic rate of the first zoeal stages of *M. acanthurus*, *M. amazonicum*, *M. carcinus*, *M. heterochirus*, *M. holthuisi* and *M. olfersii* from Brazil, and McNamara (1987) studied osmoregulation in *M. olfersii*. The present paper reports the results of an investigation on the osmotic regulation in *M. carcinus* in relation to fast and slow salinity changes.

Materials and Methods

The osmoregulatory capacity in *Macrobrachium carcinus* was estimated by comparing haemolymph osmotic concentration with that of the external medium. Juveniles and adults (10.67–13 cm and 70–125 g, length and weight respectively) were collected in the River 'La Antigua', Ver., México. The animals were acclimated in 70 L tanks in the laboratory at 20°C and 0 ppt salinity for 48 hours. After that, groups of 10 to 20 animals were placed in individual tanks to carry out the experimental protocol; this included two slow osmolarity treatments (0–7 ppt and 0–14 ppt) and two fast treatments (0–28 ppt and 0–35 ppt). One group was kept at 0 ppt throughout the experiment and served as a control. Osmolarity of the media was adjusted using a hand refractometer, reading the equivalent salinity in ppt. The osmotic pressure of 30 µL samples of haemolymph and external medium was determined in triplicate with a micro-osmometer 'µ-Osmette' (Precision Systems Inc.) every 6 hours to complete 168 hours of total observation. Haemolymph was obtained by puncture of the pericardic cavity with a capillary pipette, after the organisms had been dried with an absorbent tissue; samples were then centrifuged at 3000 rpm for 10 seconds. Concurrently pleopod setae were examined to determine moult stage.

Results and Discussion

Osmotic pressure measurements indicate that the organisms were hyperosmotic in freshwater and low salinities, maintaining their HOC (haemolymph osmotic concentrations) between 400 and 500 mOsm/kg at 0 to 15 ppt, similar to *M. olfersii* and *M. potiuna* (Moreira *et al.*, 1983). On the other hand, the isosmotic point was achieved near 490 mOsm/kg (17 ppt) compared to the value of 492 mOsm/kg given for postlarvae of *M. carcinus* (Moreira *et al.*, 1987). The species remain isosmotic at high salinities (above 500 mOsm/kg) increasing their HOC with the external concentration, especially at salinities between 17 and 25 ppt. Finally, the specimens in premoult stage had a greater HOC than organisms in postmoult stages, with values of 527 and 421 mOsm/kg respectively; the smallest values occurred in individuals just moulted (408 mOsm/kg). On the other hand, the species was isosmotic in the intermoult stage, similar to *M. rosenbergii* (Stern *et al.*, 1986).

Acknowledgements

The author wishes to express his gratitude to J.A. Viccon and A. Esquivel for reviewing the manuscript and to Biology Investigations Center of Xalapa of University of Veracruz. This research was partially supported by CONACYT (National Council of Science and Technology) and Universidad Autónoma Metropolitana.

Literature Cited

- McNamara, J.C. 1987. The time course of osmotic regulation in the freshwater shrimp *Macrobrachium olfersii* (Wiegmann) (Decapoda, Palaemonidae). *Journal of Experimental Marine Biology and Ecology* 107: 245–251.
- Moreira, G.S., McNamara, J.C., Shumway, S.E. and Moreira, P.S. 1983. Osmoregulation and respiratory metabolism in Brazilian *Macrobrachium* (Decapoda, Palaemonidae). *Comparative Biochemical Physiology* 74A(1): 57–62.
- Moreira, G.S., Ngan, P.V. and Shumway, S.E. 1987. The effect of salinity on the osmo-ionic regulation of *Macrobrachium carcinus* (Linnaeus). *Bulletin of Marine Science* 41(1): 639p.
- Stern, S., Barut, A. and Cohen, D. 1986. Osmotic and ionic regulation of the prawn *Macrobrachium rosenbergii* (De Man) adapted to varying salinities and ion concentrations. *Comparative Biochemical Physiology* 86A(2): 373–379.

B.G. Signoret Universidad Autónoma Metropolitana Xochimilco. Depto. El Hombre y su Ambiente. Calz. Hueso 1100. Col. Villa Quietud. C.P 04960. México, D.F. México.